A CONSUMER PREFERENCE STUDY OF VARIOUS VANILLA FLAVORS AND OF TEXTURES IN ICE CREAM

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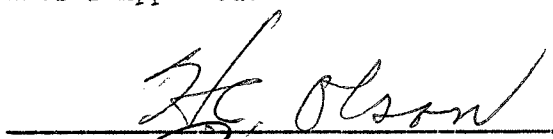

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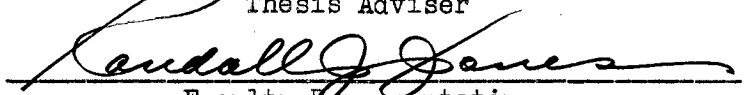

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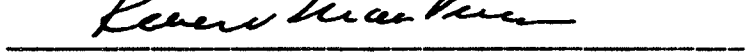

Dean of the Graduate School

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INTRODUCTION

Consumer preference surveys used to determine the likes and dislikes of the public are not new. In commercial practice the decision as to the acceptability of a particular flavor of ice cream may be left to one individual without recognition that this opinion may not be in accord with the opinions of a cross section of the consuming public.

Ice cream is popular with people of all ages. Nationally, vanilla flavored ice cream makes up about half of the total production of all ice cream. Pure vanilla extract is widely used for flavoring by many ice cream manufacturers and is considered by most experts to be the best. A considerable amount of pure vanilla extract fortified with vanillin is being used by ice cream manufacturers and artificial vanilla flavoring is also being used. The cost per gallon for flavoring ice cream with pure vanilla extract is greater than with either the fortified or the artificial product.

Very little research has been done on consumer preferences for various vanilla flavors and for textures of ice cream. This study was conducted to determine consumer preferences for (1) various types of vanilla flavoring in ice cream and (2) various textures of ice cream.

REVIEW OF LITERATURE

Very little information can be found concerning consumer preference studies on textures and types of flavors in vanilla ice cream. Woods (9) stated that ice cream consumption doubled in the 1920's and again in the 1940's. Since 1950, there has been a slight increase in the amount of ice cream consumed practically every year. She further states that over 200 different flavors of ice cream are in use today, but that vanilla is by far the most popular flavor. She points out that in 1956, 52 percent of all ice cream sold was vanilla, with chocolate flavor rating second and strawberry third.

The American Dairy Association (1) reported, in a survey of public attitudes and uses of dairy products, that ice cream has wide usage among all age groups, all income groups and in all sections of the country. This public attitudes survey covered 3,915 interviews with individuals 15 years and older and 695 interviews with children 6 to 14 years of age. The survey shows that children eat ice cream more often than do adults, and that the amount of ice cream kept on hand increases with increases in income. The survey revealed that an estimated 47,000,000 Americans eat ice cream every day and, nationally, vanilla is the favorite of about 50 percent of consumers. The survey also pointed out that consumers judge ice cream quality mainly by:

1. Texture--high quality ice cream is described as "creamy," "smooth," "velvety." Poor quality ice cream is described as "gritty," "grainy," "poor taste," "icy."

2. Taste--described as "good flavor," "rich" or "sweet."

Blakley, McMullin and Boggs (2) interviewed a random 1 percent of the Oklahoma City population in a dairy products and services survey in 1955. The study showed that 40 percent of the families interviewed reported using an average of 2.9 pints of ice cream each week. The proportion of families using ice cream was directly related to family income. About one-fourth of the lower income families reported using ice cream, and this proportion increased with income up to one-half for the highest income families.

Eckles, Combs and Macy (4) stated that ice cream is not graded on the market since it is sold by the manufacturer directly to the retailer or consumer. The qualities that constitute a good ice cream are left more or less to the judgment of the individual manufacturer and his ability to judge the preference of the public. They further stated that the defects in ice cream commonly referred to are those of flavor, body and texture, and color.

In some research on various factors affecting consumer preferences for ice cream, Crowe (3) compared pure vanilla and fortified vanilla in different concentrations. He used three basic flavors: pure vanilla, pure vanilla fortified with 5 ounces of vanillin, and pure vanilla fortified with 10 ounces of vanillin. The amounts of each of these flavors used per 5 gallons of mix were 1/2 ounce and 1 ounce. He ran consumer preference determinations on 9 combinations of these flavors. In only 3 out of the 9 comparisons were the differences significant as follows: 1. One ounce of pure vanilla extract fortified with 10 ounces of vanillin was preferred to 1/2 ounce of pure vanilla. The preference was slight but significant. 2. One ounce of pure vanilla fortified with 10 ounces of vanillin was preferred to 1/2 ounce of pure vanilla

fortified with 10 ounces of vanillin. The consumer preference was slight but significant. 3. One ounce of pure vanilla fortified with 5 ounces of vanillin was highly preferred over 1 ounce of pure vanilla.

In this latter comparison the difference appeared to be highly significant. From these results it may be inferred that the fortified vanilla was preferred over the pure vanilla. It also appeared from the data presented that a high level of flavor was desirable because the one ounce of flavoring used in each of these comparisons in which there was a significant preference was twice the level recommended by the manufacturer.

Schlotterer (8) reported that the chief use of vanilla in the United States of America is for the manufacture of ice cream. He pointed out that out of some 100 varieties of ice cream sold, the consumers' preference is for vanilla, in the proportion of 55 percent. He further stated that it is estimated that 15% of ice cream firms now use some pure vanilla, 15% use straight artificial flavor, and 70% stretch out their flavor mostly with synthetic vanillins and very little pure vanilla.

England (5) reported that operation of the freezer is very important from the standpoint of texture of the finished ice cream. Sharp blades, fast freezing and a stiff, dry ice cream are practically a must, and he highly recommends putting the ice cream in a hardening room immediately after freezing so the texture will not be affected by letting ice crystals melt.

Hovanesian (6) reported that the hardening phase of ice cream production has not kept abreast of advancements in mix making, freezing and packaging of this product. Proper hardening is, however, of utmost

importance in obtaining quality ice cream. Differences in hardening time and temperature variations during the hardening process have a distinct effect on the body and texture of the final product. He further pointed out that quick hardening produces smaller ice crystals and smoother texture than is obtained with slower hardening, and that variations in hardening temperatures result in larger crystals and coarser texture.

EXPERIMENTAL PROCEDURE

A. PREPARATION OF SAMPLES

1. Samples for flavor preference. The samples used for the determination of vanilla ice cream flavor preference were manufactured by the Dairy Department of Oklahoma State University. The mix, other than the various kinds and amounts of vanilla flavors used in the samples, was the same. The mix was composed of 12% butterfat, 11% serum solids, 15% sucrose, .18% stabilizer and .07% emulsifier. The stabilizer used was sodium alginate. The mix was pasteurized at 160° F. for 30 minutes and homogenized at 1,750 pounds pressure with a Creamery Package homogenizer.

Prior to making the ice cream samples for the consumer preference test, the amount of each flavor required to give approximately the same degree of flavor was determined. This was done by adding various amounts of the flavoring material to good quality ice cream mix and having several experienced ice cream judges evaluate the various samples. On the basis of the judges' opinions, the amounts needed for uniformly distinct vanilla flavor were determined.

In the first flavor preference survey, the three types of vanilla flavors used were: A. Artificial vanilla flavor--a commercial product for use in ice cream containing "vanillin, ethyl vanillin, vanilla, esters, aldehydes, water, alcohol and glycerin." The artificial flavor was used at the rate of 75 ml per 5 gallons of ice cream mix. B. Pure

vanilla extract--double-strength extract of 1/2 Mexican and 1/2 Bourbon beans, used at the rate of 48 ml to each 5 gallons of ice cream mix. C. Fortified vanilla--extract of 1/2 Mexican and 1/2 Bourbon beans fortified with 8 ounces of vanillin per gallon, used at the rate of 16 ml per 5 gallons of mix.

In the second flavor preference survey, the three types of vanilla flavors used were as follows: A. Artificial vanilla flavor containing "extractive matter from vanilla beans, vanillin, alcohol, propylene glycol, sugar and water," used at the rate of 7/8 ounce for each 5 gallons of ice cream mix. B. Fortified vanilla--double-strength pure vanilla extract of 1/2 Mexican and 1/2 Bourbon beans and fortified with 2 ounces of methyl vanillin per gallon, used at the rate of 7/8 ounce for each 5 gallons of ice cream mix. C. Pure vanilla--double-strength pure vanilla extract of 1/2 Mexican and 1/2 Bourbon beans, used at the rate of 1 1/2 ounces for each 5 gallons of mix.

The three types of vanilla flavoring used in the second flavor study were furnished by the Beck Vanilla Products Company of East St. Louis, Illinois. The amount of flavoring used in each sample was in accord with the recommendations of the manufacturer, as printed on the container.

The samples in both flavor studies were marked with identification letters on the outside of the gallon containers and stored in the hardening room at the Dairy Department of Oklahoma State University for 3 days before being moved to Tulsa by the author. The identifying letters were selected randomly and the keys to the identities were not revealed to the author until the surveys had been completed and the data analyzed. The samples were stored in a well insulated ice cream packer with 5

pounds of dry ice to keep them frozen solid enroute to Tulsa by automobile, a period of about 1 1/2 hours. On arrival in Tulsa, the samples were removed from the ice cream packer for inspection by the author and no thawing or softening had taken place. The samples were immediately put back in the ice cream packer and stored in the sharp-freeze room at the Glencliff Dairy Products Company until they were needed for the survey.

2. Samples for texture preference. The ice cream samples used for the determination of texture preference were manufactured by the Dairy Department of Oklahoma State University, using the same mix as was previously explained for the flavor preference samples.

One sample, classified as coarse texture, was drawn rather soft and then placed in the hardening room. Another sample, medium texture, was drawn rather soft and then stored on an upper shelf in a deep-freezer. A third sample, fine texture, was drawn firm and stored on the bottom shelf in the deep-freezer. The gallon containers of the texture samples were marked with identification letters on the outside of the cartons before being stored. The three texture samples were classified as fine, medium and coarse by two experienced ice cream judges. The samples were stored at the previously mentioned places for three days before being moved to Tulsa by the author. The three texture samples were handled and stored in the same manner as previously described for the flavor samples.

B. SELECTION OF RESPONDENTS

In both flavor preference surveys, approximately one-half of the respondents were tested in the Tulsa Secondary Schools and one-half in

supermarket food stores in Tulsa, Oklahoma. During the entire course of this study, juveniles were considered to be students below high school graduation level and adults were considered above high school graduation level.

Mr. W. Leroy Tharp, Director of Secondary Education in the Tulsa Public Schools, gave his approval for the school surveys and selected the foods classes at the Nathan Hale High School in Tulsa as the representative group to participate in the study. Average family income and interest in foods were the two main factors taken into consideration in selecting this group as average. No respondent participated in more than one comparison in either survey.

Three supermarket food store managers in different economic areas of Tulsa granted permission to the author to interview consumers in their stores as the consumers passed the ice cream counter. The respondents in the stores were selected at random. When the preference sample rank was completed and the preference chart or questionnaire filled out on the respondent, the next consumer passing the ice cream section was asked to make the ice cream preference test. If a consumer did not wish to make the taste test, the next person passing the ice cream section in the store was asked to participate.

During each of the consumer preference surveys, only the two or three samples of ice cream being tested were removed from the sharp-freeze storage at one time and then for not more than one-half of a day at a time. During the school surveys, the ice cream was taken out of a deep-freezer at school only long enough to dip the samples being tested. While the preference surveys were being made at the food stores, the ice cream samples were placed in the ice cream freezer case and dipped as

needed for the respondents. In both schools and food stores, the ice cream was frozen firmly enough at all times that it was difficult to dip.

C. EXAMINATION PROCEDURE

1. First flavor preference survey. Each respondent in the first flavor preference study was given a plastic spoon and a paper plate on which about a tablespoon of each of three samples of ice cream had been placed. The paper plate had previously been marked off in three equal sections and numbered with identification letters to match the three flavor samples. The respondents were first asked to taste the three samples of ice cream and rank them according to their taste preference for vanilla flavored ice cream. After the three samples of vanilla ice cream had been ranked according to preference, ten questions on a questionnaire were read verbatim to each respondent. If any explanation was needed the interviewer attempted to give this in such a way so as not to bias the answer given by the respondent. A copy of the questionnaire is shown on page 11.

2. Second flavor survey and texture preference survey. A preference sheet used in this survey was patterned after the one used in a consumer preference study made by Crowe (3). The preference sheet included terms that most nearly described the respondents reactions to the samples being tested. The sheet was modified to include both flavor and texture reactions, with a blank space at the top to be filled in either with the word "texture" or "flavor," depending on the preference test being made. A copy of the preference sheet used is shown on page 12.

Each respondent, in both groups of the preference survey on flavor and texture, was tested in essentially the same manner as previously

ICE CREAM SURVEY
VANILLA FLAVOR

Date:_____

Age: A_____J_____

Sex: M_____F_____

Occupation_____

Sample No.	Rank	Criticisms
A		
B		
C		

OPINIONS REGARDING FROZEN DESSERTS

1. Do you know the differences between ice cream, ice milk and mellorine? Yes _____ No _____.

2. How does ice milk differ from ice cream? _____

3. How does Mellorine differ from ice milk? _____

4. How often do you serve ice cream per week? _____

5. Do you generally serve the ice cream as it comes from the container? Yes _____ No _____. If not, how do you change it?_____

6. Has the ice cream you have been purchasing recently been satisfactory? Yes _____ No _____.

7. What criticisms do you have regarding the quality of ice cream?

_____

8. Why do you include ice cream in your menus? _____

_____

9. Why don't you use more ice cream? _____

_____

10. Which do you consider the better: Home-made ice cream _____

Commercial ice cream _____

Why? _____

CONSUMER ICE CREAM PREFERENCE STUDY

Factor Studied _____

Date_____ Age: Adult_____ Juvenile_____

Name_____ Sex: Male _____ Female _____

Circle sample preferred: A B C

Difference between samples: Slight_____Moderate_____Great_____

Quality of sample you chose: Good_____Fair_____Poor_____

Criticisms of sample:

Reasons for preference:

Better flavor_____ Better body_____

More flavor _____ Better texture_____

Richer taste _____ Others_____

explained in the first flavor survey, except that only two samples of ice cream were compared at a time.

The respondents were first asked to examine the two samples of ice cream and rank them according to their preference for flavor and texture, depending on what was being compared. The preference sheet lists Samples A, B and C. The sample not being tested was marked out before two samples were compared by the respondents.

After the samples had been ranked according to preference, the items listed on the sheet were read to the respondents verbatim and they selected the term most nearly describing their reactions to each sample. One or more reasons for preference on ice cream flavor and texture were selected by each respondent. If any explanation was needed, the author attempted to give this in such a way so as not to bias the answer given by the respondent. All respondents were able to answer all the questions on the preference data sheet.

D. DETERMINATION OF CONSUMER PREFERENCES

1. Consumer Score. The procedure used for calculating the results for the first survey on consumer flavor preferences is one described by Olson and Strozier (7). In these trials, three samples were employed and the consumer score was calculated for each sample by multiplying the number of times it placed first by 3, second by 2 and third by 1, and totalling these sums.

2. Preference Significance. The procedure for calculating the results for the second flavor and texture survey is described by Crowe (3). The results were tested for significance by the calculation: $2X-N$, where X equals the number of preferences for a particular sample

and N equals the number of opinions. This result was compared with 1.96 times the square root of N. If 2X-N is greater than 1.96 times the square root of N, then the preference is considered to be significant.[c]

EXPERIMENTAL RESULTS AND DISCUSSION

A. CONSUMER PREFERENCE FOR VARIOUS TYPES OF VANILLA FLAVORS IN ICE CREAM

1. First survey. The purpose of this survey was to determine consumer preferences for vanilla ice cream flavored with artificial, fortified, and pure vanilla. The results obtained on preference rank, from 74 juveniles and 128 adults, for the three types of vanilla flavored ice cream samples are shown separately in Table I.

The results obtained from the 74 juveniles showed that the sample containing artificial flavor was most preferred with 47.3% selecting it as first place, 31.1% as second place and 21.6% as third place, with a consumer score of 167. The sample flavored with pure vanilla extract fortified with vanillin ranked second with 33.8% of the respondents ranking it first, 40.5% ranking it second and 25.7% ranking it third, with a consumer score of 154. The sample flavored with pure vanilla extract ranked third with only 16.2% ranking it first, 29.7% ranking it second and over half, 54.1%, ranking it third, with a consumer score of 120. These results indicate that the artificial vanilla flavored sample was preferred slightly over the pure vanilla sample fortified with vanillin, and the fortified vanilla sample was slightly preferred over the pure vanilla sample.

The results obtained from the 128 adults (Table I) showed that the artificial vanilla sample of ice cream was most preferred with 43.0% ranking it first, 27.3% second and 29.7% third place, with a consumer

TABLE I

PREFERENCE FOR VARIOUS TYPES OF VANILLA FLAVORS IN ICE CREAM
BY ADULTS AND JUVENILES IN FIRST SURVEY

74 Juveniles and 128 Adults

Placing	Juvenile Preference				Adult Preference			
	No.	%	Score*	Rank	No.	%	Score*	Rank
Artificial Vanilla								
First	35	47.3	105		55	43.0	165	
Second	23	31.1	46		35	27.3	70	
Third	16	21.6	16		38	29.7	38	
Total	74	100.0	167	1	128	100.0	273	1
Pure Vanilla								
First	12	16.2	36		45	35.2	135	
Second	22	29.7	44		42	32.8	84	
Third	40	54.1	40		41	32.0	41	
Total	74	100.0	120	3	128	100.0	260	2
Fortified Vanilla								
First	25	33.8	75		29	22.7	87	
Second	30	40.5	60		51	39.8	102	
Third	19	25.7	19		48	37.5	48	
Total	74	100.0	154	2	128	100.0	237	3

*See method for calculating consumer score.

score of 273. The adults showed a slight preference for the pure vanilla sample over the fortified sample with 35.2% ranking the pure vanilla sample first, 32.8% second and 32.0% third, with a consumer score of 260. The fortified sample was the least preferred by the adults with only 22.7% ranking it first place, 39.8% second and 37.5% third, with a consumer score of 237. The total scores for the adults showed a slight preference for the artificial vanilla sample over the pure sample and a slight preference for the pure over the fortified vanilla sample.

The results obtained from all respondents, 74 juveniles and 128 adults, are shown in Table II. The results show that the artificial vanilla sample was most preferred with 44.6% ranking it first place, 28.7% second and 26.7% third, with a consumer score of 440. The fortified vanilla sample ranked second with 26.7% ranking it first place, 40.0% second and 33.3% third place, with a consumer score of 391. The sample flavored with pure vanilla was ranked third or last place with 28.2% ranking it first place, 31.8% second and 40.0% third place, with a consumer score of 380. The data indicates a slight preference by all respondents for the artificial vanilla sample over the fortified sample, and a slight preference for the fortified over the pure vanilla sample.

2. Second survey. A second survey was run on consumer preference for vanilla flavors, using a slightly different examination procedure and applying mathematical determinations for significance. In this survey only two samples were examined by each respondent and the respondent was asked to designate the better of the two samples. Results obtained from 144 respondents, composed of 81 juveniles and 63 adults, are presented in Table III.

The data shows that when the artificial vanilla sample was

TABLE II

PREFERENCE FOR VARIOUS TYPES OF VANILLA FLAVORS IN ICE CREAM
BY ALL RESPONDENTS IN FIRST SURVEY

202 Respondents

Placing	TYPE OF VANILLA FLAVOR					
	Artificial Vanilla Respondents		Pure Vanilla Respondents		Fortified Vanilla Respondents	
	No.	%	No.	%	No.	%
First	90	44.6	57	28.2	54	26.7
Second	58	28.7	64	31.8	81	40.0
Third	54	26.7	81	40.0	67	33.3
Total	202	100.0	202	100.0	202	100.0
Score	440		380		391	
Rank	1		3		2	

TABLE III

PREFERENCE FOR VARIOUS TYPES OF VANILLA FLAVORS IN ICE CREAM
BY JUVENILES IN SECOND SURVEY

81 Juveniles

Samples Flavored With	No. of Respondents Preferring	% of Respondents Preferring	2X-N	$1.96\sqrt{N}$	*Preference Indicated
		24 RESPONDENTS			
Artificial	15	62.5	6	9.60	None
Fortified	9	37.5			
		29 RESPONDENTS			
Artificial	21	72.4	13	10.55	Slightly Significant
Pure	8	27.6			
		28 RESPONDENTS			
Fortified	15	53.6	2	10.37	None
Pure	13	46.4			

*See method for calculating Preference Indication

compared with the fortified sample, 15 or 62.5% of the 24 respondents preferred the artificial vanilla sample and only 9 or 37.5% preferred the fortified vanilla sample. The results from this percentage indicated there was a slight preference for the artificial vanilla sample over the fortified sample, but when the results were tested for significance by the calculation on page 12, no significant preference was shown.

When the sample flavored with the fortified vanilla was compared with that flavored with the pure vanilla, 15 or 53.6% of the 28 respondents preferred the fortified and 13 or 46.4% preferred the pure vanilla sample. The results indicated a very slight preference for the fortified over the pure vanilla sample, but the calculation for significance showed there was no significant preference.

The results obtained from 63 adults in the second flavor preference survey are shown in Table IV. The results show that when the artificial vanilla sample was compared with the fortified vanilla sample, 16 or 72.7% of the 22 respondents preferred the artificial and only 6 or 27.3% preferred the fortified vanilla sample. This comparison indicated a definite preference for the artificial over the fortified vanilla sample and the calculation for significance showed there was a slightly significant preference.

The results obtained in Table IV showed that when the samples flavored with the artificial vanilla were compared with those flavored with the pure vanilla, 16 or 84.2% of the 19 respondents preferred the artificial and only 3 or 15.8% preferred the pure vanilla sample. The comparison indicated a preference for the artificial over the pure vanilla sample and a slightly significant preference was shown by calculation.

TABLE IV

PREFERENCE FOR VARIOUS TYPES OF VANILLA FLAVORS IN ICE CREAM

BY ADULTS IN SECOND SURVEY

63 Adults

Samples Flavored With	No. of Respondents Preferring	% of Respondents Preferring	2X-N	$1.96\sqrt{N}$	Preference Indicated
		22 RESPONDENTS			
Artificial	16	72.7	10	9.19	Slightly Significant
Fortified	6	27.3			
		19 RESPONDENTS			
Artificial	16	84.2	13	8.54	Slightly Significant
Pure	3	15.8			
		22 RESPONDENTS			
Fortified	12	54.5	2	9.19	None
Pure	10	45.5			

When the fortified sample was compared with the pure vanilla sample by 22 adult respondents, the results obtained showed that 12 or 54.5% preferred the fortified and 10 or 45.5% preferred the pure vanilla sample. This comparison indicated a slight preference for the fortified over the pure vanilla sample, but the calculation for significance showed there was no significant preference.

The results obtained on the second flavor preference survey from all respondents, 81 juveniles and 63 adults, are shown in Table V. These results showed that when the samples flavored with the artificial vanilla were compared with those flavored with fortified vanilla, 31 or 67.4% of the 46 respondents preferred the artificial and 15 or 32.6% preferred the fortified vanilla sample. This comparison indicated a preference for the artificial over the fortified vanilla samples and the calculation for significance also showed a slightly significant preference.

When the samples flavored with the artificial vanilla were compared with those flavored with the pure vanilla, 37 or 77.1% of the 48 respondents preferred the artificial and 11 or 22.9% preferred the pure vanilla samples. This comparison indicated the artificial was highly preferred over the pure vanilla samples and a highly significant preference was also shown by calculation.

When the samples flavored with the fortified vanilla were compared with those flavored with pure vanilla, 27 or 54.0% of the 50 respondents preferred the fortified and 23 or 46.0% preferred the pure vanilla samples. This comparison indicated a very slight preference for the fortified over the pure vanilla samples, but the calculation for significance test showed there was no significant preference.

TABLE V

PREFERENCE FOR VARIOUS TYPES OF VANILLA FLAVORS IN ICE CREAM

BY ALL RESPONDENTS IN SECOND SURVEY

81 Juveniles and 63 Adults

Samples Flavored With	No. of Respondents Preferring	% of Respondents Preferring	2X-N	$1.96\sqrt{N}$	Preference Indicated
46 RESPONDENTS					
Artificial	31	67.4	16	13.29	Slightly Significant
Fortified	15	32.6			
48 RESPONDENTS					
Artificial	37	77.1	26	13.58	Highly Significant
Pure	11	22.9			
50 RESPONDENTS					
Fortified	27	54.0	4	13.86	None
Pure	23	46.0			

A total of 346 respondents participated in the two flavor preference surveys. The combined results obtained in the two surveys, where each two samples were compared 6 times, showed that the artificial vanilla sample was preferred by the largest number of consumers. The results showed that the artificial was preferred over the pure vanilla sample in each of the 6 comparisons. The results from the first flavor survey showed that the artificial was moderately preferred over the pure vanilla sample. When the data were subjected to calculation for significance, the preference for the samples flavored with artificial vanilla over those flavored with pure vanilla was slight for the juveniles, moderate for the adults, and highly significant for the combined group.

The results showed that the artificial was preferred over the fortified vanilla sample in each of the 6 comparisons in the two flavor surveys. The artificial was slightly preferred over the fortified vanilla sample in each of the 3 comparisons in the first flavor survey. The data obtained from the second flavor survey showed a slight preference by calculation for the artificial over the fortified vanilla sample by adults, and a percentage preference of 62.5% to 37.5% for the artificial over the fortified sample by the juveniles.

The fortified sample was preferred over the pure vanilla sample in 5 of the 6 times they were compared in the two flavor surveys. The results obtained from the adults in the first survey showed that they slightly preferred the pure over the fortified vanilla sample. In each of the other 5 comparisons, the fortified was slightly preferred over the pure vanilla sample but not to a degree that any preference for significance was shown by calculation.

B. REASONS GIVEN FOR PREFERENCE FOR TYPES OF VANILLA FLAVORED ICE CREAM BY CONSUMERS

A questionnaire was used in the second flavor survey that included terms most nearly describing the respondents reactions to the samples being tested. The questionnaire included both flavor and texture reactions, and the respondents making the flavor test checked one or more of the four flavor terms listed. The check terms for flavor preference were "better flavor," "more flavor," "richer taste" and "others." Such a small number gave "others" for a reason that this term was eliminated in the results in Table VI. The questionnaire provided space for the respondents to check whether they considered the difference in the two samples being tested to be "slight," "moderate" or "great" and whether the sample preferred was considered "good," "fair" or "poor." A space was also provided for criticisms of the samples not chosen.

The data obtained from the 144 respondents, 81 juveniles and 63 adults, is shown in Table VI. The results show that, of the 31 respondents preferring the artificial over the fortified vanilla sample, 16 or 51.6% considered the difference between samples to be moderate, and 7 or 46.6% of the 15 respondents preferring the fortified over the artificial sample thought the difference to be moderate. Of the 37 respondents preferring the artificial over the pure vanilla sample, 17 or 46.0% considered the difference to be slight and 15 or 40.5% to be moderate. The data shows that 5 or 45.4% of the 11 respondents preferring the pure over the artificial vanilla sample considered the difference between samples to be moderate. Of the 27 respondents preferring the fortified over the pure vanilla sample, 16 or 59.3% thought the difference between samples was slight, and 15 or 65.2% of the 23 respondents preferring the

TABLE VI

REASONS GIVEN FOR PREFERENCE FOR VARIOUS TYPES OF VANILLA FLAVORED ICE CREAM BY CONSUMERS

81 Juveniles and 63 Adults

Prepared Vanilla Ice Cream Samples		No. of Preferences	Difference Between Samples			Reasons for Preference			Quality of Sample Chosen		Criticisms of Sample not Chosen
			Slight	Moderate	Great	Better Flavor	More Flavor	Richer Taste	Good	Fair	
Artificial over Fortified		31	8	16	7	20	17	14	29	2	5
	%	67.4	25.8	51.6	22.6	64.5	54.8	45.2	93.6	6.4	16.1
Fortified over Artificial		15	4	7	4	8	3	8	14	1	2
	%	32.6	26.7	46.6	26.7	53.5	20.0	53.5	93.3	6.7	13.3
Artificial over Pure		37	17	15	5	22	19	22	36	1	5
	%	77.0	46.0	40.5	13.5	59.5	51.4	59.5	97.3	2.7	13.5
Pure over Artificial		11	3	5	3	8	1	5	11		5
	%	23.0	27.3	45.4	27.3	72.7	9.1	45.4	100.0		45.4
Fortified over Pure		27	16	6	5	20	11	18	25	2	5
	%	54.0	59.3	22.2	18.5	74.1	40.7	66.7	92.6	7.4	18.5
Pure over Fortified		23	7	15	1	16	13	9	21	2	2
	%	46.9	30.4	65.2	4.4	69.6	56.5	39.1	91.3	6.7	6.7
TOTAL		144	55	64	25	94	64	76	136	8	24
	%	100.0	38.2	44.4	17.4	65.2	44.4	52.8	94.4	5.6	16.7

pure over the fortified vanilla sample considered the difference between samples to be moderate. It seemed from these results that a large majority of the respondents considered the difference between the two samples being tested each time to be slight or moderate. Only 25 or 17.4% of the 144 respondents making the comparisons considered the difference to be great between samples.

The reasons given for preference by the 144 respondents show that 94 or 65.2% listed better flavor as a preference reason, 76 or 52.8% listed richer taste, and 64 or 44.4% listed more flavor. These results indicate that the kind of flavor, or better flavor, was considered a greater preference factor than more flavor or richer taste by the 144 respondents making the test.

The data in Table VI shows that 136 or 94.4% of the 144 respondents making the vanilla ice cream flavor test considered the quality of the samples chosen each time to be good, and only 8 or 5.6% fair. All 11 of the respondents preferring the pure vanilla over the artificial vanilla sample thought the quality of the sample preferred to be good. It seemed from these results that the 11 respondents recognized pure vanilla and therefore indicated a great preference for it over the artificial or fortified products. Of these 11 respondents, 5 or 45.4% gave criticisms of the sample not chosen, by far the largest percentage of any group making the comparisons. Only 24 or 16.7% of the 144 respondents making the flavor comparisons gave criticisms of the samples not chosen.

C. PREFERENCE FOR VARIOUS TEXTURES IN VANILLA FLAVORED ICE CREAM

Results were obtained from 152 respondents, 71 juveniles and 81 adults, in the ice cream texture preference survey. The results obtained from the 71 juveniles are shown in Table VII. The data showed that 16 or 76.2% of the 21 respondents preferred the medium textured sample over the coarse and only 5 or 23.8% the coarse textured sample over the medium. The results from this comparison indicated a strong majority preference for the medium over the coarse textured sample and when the results were tested for significance by calculation, a slightly significant preference was shown.

The results obtained showed that when the coarse textured sample was compared with the fine textured ice cream sample, 11 or 61.1% of the 18 juvenile respondents preferred the fine textured sample and 7 or 38.9% the coarse textured sample. The results from this percentage comparison indicated a slight preference for the fine over the coarse textured sample, but when the results were tested for significance by calculation, no significant preference was indicated.

The results obtained in Table VII showed that when the fine textured sample of ice cream was compared with the medium textured sample, 18 or 56.2% of the 32 respondents making the test preferred the fine and 14 or 43.8% the medium textured sample. The results from this percentage comparison indicated the respondents preferences were about equal for the fine and medium textured samples, and when the results were checked for significance by calculation, no significant preference was indicated.

The data obtained from 81 adults in the ice cream texture preference survey is shown in Table VIII. The results showed that when the

TABLE VII

PREFERENCE FOR VARIOUS TEXTURES IN ICE CREAM

BY JUVENILES

71 Respondents

Texture of Samples	No. of Respondents Preferring	% of Respondents Preferring	2X-N	$1.96\sqrt{N}$	Preference Indicated
21 RESPONDENTS					
Coarse	5	23.8			
Medium	16	76.2	11	8.98	Slightly Significant
18 RESPONDENTS					
Coarse	7	38.9			
Fine	11	61.1	4	8.31	None
32 RESPONDENTS					
Medium	14	43.8			
Fine	18	56.2	4	11.08	None

TABLE VIII

PREFERENCE FOR VARIOUS TEXTURES IN ICE CREAM

BY ADULTS

81 Respondents

Texture of Samples	No. of Respondents Preferring	% of Respondents Preferring	$\bar{2X}-N$	$1.96\sqrt{N}$	Preference Indicated
31 RESPONDENTS					
Coarse	17	54.8	4	10.23	None
Medium	14	45.2			
30 RESPONDENTS					
Coarse	13	43.3			
Fine	17	56.7	4	10.23	None
20 RESPONDENTS					
Medium	6	30.0			
Fine	14	70.0	8	8.76	None

coarse textured ice cream sample was compared with the medium textured sample, 17 or 54.8% of the 31 respondents making the test preferred the coarse textured sample and 14 or 45.2% preferred the medium textured sample. This percentage comparison indicated a slight consumer preference for the coarse textured sample, but when the results were checked for significance by calculation, no significant preference was indicated.

The data in Table VIII shows that when the fine textured ice cream sample was compared with the coarse textured sample, 17 or 56.7% of the 30 respondents preferred the fine textured sample and 13 or 43.3% preferred the coarse textured sample. The percentage comparison indicated there was very little if any preference shown in the comparison between the coarse and fine textured samples and when the results were tested for significance by calculation, no significant preference was indicated.

The results showed that when the fine textured sample was compared with the medium textured sample by adults, 14 or 70.0% of the 20 respondents preferred the fine textured sample and only 6 or 30.0% preferred the medium textured sample. The results from this percentage comparison indicated that a large majority of the respondents preferred the fine textured sample over the medium textured sample, but when the results were tested for significance by calculation, no significant preference was indicated.

The data obtained from all respondents, 71 juveniles and 81 adults, in the ice cream texture preference survey is shown in Table IX. The results show that when the coarse textured sample was compared with the medium textured sample, 30 or 57.7% of the 52 respondents preferred the medium textured sample and 22 or 42.3% preferred the coarse textured sample. This percentage comparison shows a slight consumer preference

TABLE IX

PREFERENCE FOR VARIOUS TEXTURES IN ICE CREAM

BY ALL RESPONDENTS

71 Juveniles and 81 Adults

Texture of Samples	No. of Respondents Preferring	% of Respondents Preferring	2X-N	$1.96\sqrt{N}$	Preference Indicated
52 RESPONDENTS					
Coarse	22	42.3			
Medium	30	57.7	8	14.31	None
48 RESPONDENTS					
Coarse	20	41.7			
Fine	28	58.3	8	13.58	None
52 RESPONDENTS					
Medium	20	38.5			
Fine	32	61.5	12	14.13	None

for the medium over the coarse textured sample, but when the results were tested for significance for calculation, no significant preference was indicated.

The results in Table IX show that when the fine textured sample was compared with the coarse textured sample of ice cream by all respondents, 28 or 58.3% of the 48 respondents preferred the fine textured sample and 20 or 41.7% preferred the coarse textured sample. These percentage results indicated a slight consumer preference for the fine over the coarse textured sample, but when the results were tested for significance by calculation, no significant preference was indicated.

The results show that when the fine textured sample of ice cream was compared with the medium textured sample, 32 or 61.5% of the 52 respondents preferred the fine textured sample and 20 or 38.5% preferred the medium textured sample. The percentage results indicated a slight consumer preference for the fine over the medium textured sample, but when the results were tested for significance by calculation, no significant preference was indicated.

The results obtained from the 152 consumers who participated in the ice cream texture preference survey indicated that most consumers can detect fine, medium, and coarse textures in ice cream. The results obtained indicated a slight preference for the fine textured sample over the medium textured sample and a slight preference for the medium textured sample over the coarse textured sample. Only one time during the nine texture comparisons was there an exception to the above indication. The one exception was when the coarse textured sample was preferred over the medium textured sample by 31 adults as shown in Table VIII by a percentage comparison of 54.8 to 45.2. In only one comparison was any

preference for significance indicated by calculation, and this was shown in the results obtained from 21 juveniles who preferred the medium textured sample over the coarse textured sample by a calculation for significance of 11 to 8.98.

D. REASONS GIVEN FOR PREFERENCE FOR TEXTURES

A preference sheet was used in the ice cream texture preference survey that included terms most nearly describing the respondents reactions to the samples being tested. The sheet included both flavor and texture reactions and the respondents making the texture test checked one or more of the flavor terms which were "more flavor," "better flavor" and "richer taste." The respondents also checked one or more of the texture terms which were "better body," "better texture" and "others." Such a small number listed "others" for a reason that this term was eliminated in Table X. The sheet also provided space for the respondents to check whether they considered the difference between the two samples being tested to be "slight," "moderate" or "great," and whether the sample preferred was considered "good," "fair" or "poor." All of the respondents checked all three samples as good or fair, so the "poor" column has been eliminated in Table X. The sheet also provided a space for the respondents to list criticisms for the samples not preferred.

The data obtained from the 152 respondents, 71 juveniles and 81 adults, is shown in Table X. The results show that 92 or 60.5% of the 152 respondents making the texture preference test considered the difference between samples to be slight. All except one group making the combination comparisons considered the difference between samples to be slight at least 50% of the time. The exception was when 9 or 45.0% of

TABLE X

REASONS GIVEN FOR PREFERENCES FOR TEXTURES
IN ICE CREAM BY CONSUMERS

71 Juveniles and 81 Adults

Texture Preference Samples		No. of Preferences	Difference Between Samples			Reasons for Preference					Quality of Sample Chosen		Criticisms of Sample not Chosen
			Slight	Moderate	Great	Better Flavor	More Flavor	Richer Taste	Better Body	Better Texture	Good	Fair	
Coarse over Medium		22	18	4		16	5	4	7	15	22		8
	%	42.3	81.8	18.2		72.7	22.7	18.2	31.8	68.2	100.0		36.3
Medium over Coarse		30	18	7	5	18	5	20	6	24	29	1	9
	%	57.7	60.0	23.3	16.7	60.0	16.7	66.7	20.0	80.0	96.7	3.3	30.0
Coarse over Fine		20	9	3	8	15	6	11	2	17	20		0
	%	41.7	45.0	15.0	40.0	75.0	30.0	55.0	10.0	85.0	100.0		0.0
Fine over Coarse		28	20	7	1	23	3	7	7	21	28		5
	%	58.3	71.4	25.0	3.6	82.1	10.7	25.0	25.0	75.0	100.0		17.9
Medium over Fine		20	10	9	1	14	3	5	11	6	17	3	3
	%	38.5	50.0	45.0	5.0	70.0	15.0	25.0	55.0	30.0	85.0	15.0	15.0
Fine over Medium		32	17	13	2	19	11	10	9	22	31	1	6
	%	61.5	53.1	40.6	6.3	59.4	34.4	31.3	28.1	68.9	96.9	3.1	18.8
TOTAL		152	92	43	17	105	33	57	42	105	147	5	31
	%	100.0	60.5	28.3	11.2	69.1	21.7	37.5	27.6	69.1	96.7	3.3	20.4

the 20 respondents preferring the coarse over the fine textured sample considered the difference between samples to be slight, 3 or 15.0% moderate and 8 or 40.0% great. These results indicate that a majority of the 152 respondents making the texture tests considered the difference between samples to be slight.

The results in Table X show that, of the 152 respondents making the texture preference tests, 105 or 69.1% listed better flavor and 105 or 69.1% listed better texture as reasons for their preferences. A majority of each group of respondents making the texture tests considered better flavor as a reason for preference and only one combination group failed to list better texture as a preference reason at least 50% of the time. Only 6 or 30.0% of the 20 respondents preferring the medium over the fine textured sample considered better texture as a reason for preference. Since each respondent was allowed to give more than one reason for preference, the total reasons equal more than 100% for the number of people. Only 33 or 21.7% of the 152 respondents gave more flavor as a reason for preference, 57 or 37.5% richer taste and 42 or 27.6% better body. Since better flavor and better texture was each considered reasons for preference by 105 or 69.1% of the respondents, the results indicate that they were the two most important reasons for making the texture preference decisions by the 152 respondents.

The results in Table X show that 147 or 96.7% of the 152 respondents making the ice cream texture preference test considered the quality of the samples preferred each time to be good. The medium textured sample was considered a fair quality sample by four of the respondents who preferred it over the coarse and fine textured samples and one respondent considered the fine textured sample to be fair quality when it

was preferred over the medium textured sample. These results indicate that a large majority of the 152 respondents who participated in the texture preference test considered the quality of the samples preferred in each of the texture combinations to be good.

The results in Table X show that the medium textured sample was criticized by 8 or 36.3% of the 22 respondents preferring the coarse over the medium textured sample and by 6 or 18.8% of the 32 respondents preferring the fine over the medium textured sample. The coarse textured sample was criticized by 9 or 30.0% of the 30 respondents preferring the medium over the coarse textured sample and by 5 or 17.9% of the 28 respondents preferring the fine over the coarse textured sample. The fine textured sample was criticized by 3 or 15.0% of the 20 respondents preferring the medium over the fine textured sample and no criticisms were given for the fine textured sample by the 20 respondents who preferred the coarse over the fine textured sample. It appears from these results that a goodly number of respondents recognized the fine textured sample and indicated a definite preference for it over the medium and coarse textured samples.

E. CONSUMERS' OPINIONS REGARDING FROZEN DESSERTS

A questionnaire was prepared and included as a part of the first flavor preference survey. The 202 respondents participating in the survey were read each question and their answers recorded. The questions asked and the responses received are given in the order in which they appeared on the questionnaire.

1. Do you know the difference between ice cream, ice milk and Mellorine? In answer to this question, 82 or 40.6% of the respondents

answered "yes" and 120 or 59.4% answered "no."

2. How does ice milk differ from ice cream? In answer to this question, 72 or 87.8% of the 82 respondents indicating that they knew the difference stated that ice milk was lower in fat content, 8 or 9.6% stated that all the butterfat had been removed from the ice milk, 4 or 4.9% that milk was used instead of cream in the ice milk and 3 or 3.7% that there were fewer calories in the ice milk. More than one difference was listed by 5 of the 82 respondents that indicated they knew the difference in ice milk and ice cream.

3. How does Mellorine differ from ice milk? In answer to this question, 71 or 86.6% of the 82 respondents indicating that they knew the difference stated that the difference was the fat source used in the manufacture of the product, 5 or 6.1% that they didn't know the difference, 3 or 3.7% that the butterfat had been removed from the Mellorine, 2 or 2.4% that Mellorine was higher in fat and 1 or 1.2% that Mellorine was made with cream.

4. How often do you serve ice cream per week? Two of the 202 respondents reported that they never serve or eat ice cream. Of the remaining 200 respondents, 58 or 29.0% stated that they served ice cream 7 times a week, 2 or 1% said 6 times, 11 or 5.5% said 5 times, 16 or 8% said 4 times, 35 or 17.5% said 3 times, 30 or 15% said 2 times, 41 or 20.5% said 1 time a week, 3 or 1.5% said 2 times monthly and 5 or 2.5% reported 1 time monthly.

5. Do you generally serve the ice cream as it comes from the container? In answer to this question, 146 or 73.0% of the 200 respondents answered "yes" and 54 or 27.0% answered "no."

If not, how do you change it? Of the 54 respondents answering "no"

to the first part of the question, 48 or 88.9% stated that they add syrup or nuts to the ice cream.

6. Has the ice cream you have been purchasing recently been satisfactory? In answer to this question, 197 or 98.5% of the 200 respondents answered "yes" and 3 or 1.5% answered "no."

7. What criticisms do you have regarding the quality of ice cream? In answer to this question, 190 or 95.0% of the 200 respondents answered "none," 5 or 2.5% said "poor quality" and 5 or 2.5% said "it contains too much air."

8. Why do you include ice cream in your menus? In answer to this question, 157 or 78.5% of the 200 respondents who use ice cream stated they included ice cream in their menus because their families like it, 33 or 16.5% because it is nutritious, 29 or 14.5% said it is easy to prepare and serve, 16 or 8% stated it makes a good dessert, 5 or 2.5% said because of medical reasons and 4 or 2% because it is economical. Several of the respondents gave more than one reason.

9. Why don't you use more ice cream? In answer to this question, 77 or 38.5% of the 200 respondents reported that they didn't desire ice cream more often, 29 or 14.5% said because of high calorie count, 23 or 11.5% because it was not available at home, 14 or 7% didn't know why, 20 or 10% said it was too cold to eat in winter months, 9 or 4.5% reported because of a lack of storage space, 1 or 0.5% said his storage space was unhandy and required too much energy to get the ice cream and 27 or 13.3% of the respondents reported that it was too expensive.

10. Which do you consider the better, home-made ice cream or commercial ice cream? In answer to this question, 101 or 50.5% of the 202 respondents said "commercial" ice cream, 97 or 48.5% reported "home-made"

ice cream and 4 or 2% had no preference.

Why? In answer to the second part of this question, 38 or 37.6% of the 101 respondents who stated they preferred the commercial ice cream said it was easier to prepare and serve, 34 or 33.7% because it was better quality consistently, 31 or 30.7% said it had a better flavor, 14 or 13.9% reported "better texture," 7 or 6.9% said lower cost and 7 or 6.9% reported more varieties available.

Of the 97 respondents preferring home-made ice cream, 75 or 77.3% stated they liked it better because it had a better flavor, 38 or 39.2% because it was richer, 4 or 4.1% because it contained less calories and 3 or 3.1% because it contained less air.

SUMMARY AND CONCLUSIONS

A study was conducted to determine consumer preferences for various vanilla flavors and of textures in ice cream.

The respondents participating in this study consisted of students enrolled in foods classes at the Nathan Hale High School and adult food shoppers in three super market food stores in Tulsa, Oklahoma.

The samples of ice cream used for this study were prepared in the dairy plant at Oklahoma State University. They were submitted to the respondents for flavor and texture preference. Additional information was gained by interviewing the participants in the first flavor survey regarding their opinions of frozen desserts and the participants in the second survey on flavor and texture for their reasons for preferences.

A total of 346 respondents participated in the two flavor preference surveys. The results obtained in the two flavor preference surveys, where each two samples were compared 6 times, showed that the artificial vanilla samples were preferred over the pure vanilla samples in each of the 6 comparisons. The results obtained from the first flavor survey showed that the artificial was moderately preferred over the pure vanilla sample. The results obtained in the second flavor survey showed a slight preference for significance by calculation for the artificial over the pure vanilla sample by juveniles, a moderate preference by calculation by adults and a strong preference by calculation by all respondents.

The results obtained showed that the artificial samples were

preferred over the fortified vanilla samples in each of the 6 comparisons in the two flavor surveys. The artificial was slightly preferred over the fortified samples in each of the 3 comparisons in the first flavor survey. The results obtained from the second flavor survey showed a slight preference for significance by calculation for the artificial over the fortified sample by adults, a slight preference by calculation for all respondents and a preference of 62.5% to 37.5% for the artificial over the fortified vanilla sample by the juveniles.

The results obtained in the two flavor surveys further showed that the fortified samples were preferred over the pure vanilla samples in 5 of the 6 comparisons. The results obtained from the adults in the first flavor survey showed that the adults slightly preferred the pure over the fortified vanilla sample. In each of the 5 other comparisons, the fortified samples were slightly preferred over the pure vanilla samples but not to a degree that any preference for significance by calculation was shown.

The general results in the flavor preference studies indicated that consumers ranked the ice cream flavors in the order: artificial, first, fortified, second and pure vanilla, third.

The results obtained from the 152 respondents that participated in the ice cream texture preference survey indicated that many consumers can detect fine, medium and coarse textures in ice cream and prefer the fine over the medium or coarse. The results obtained in the ice cream texture survey showed a slight consumer preference by percentage for the fine textured over the medium textured sample and a slight preference for the medium over the coarse textured sample. Only once during the nine texture comparisons was there an exception to the above results.

The one exception was when the coarse textured sample was preferred over the medium textured sample by 31 adults by a percentage comparison of 54.8 to 45.2. In only one comparison was any preference for significance by calculation indicated; and this was shown in the results obtained from 21 juveniles who preferred the medium over the coarse textured sample by a calculation for significance preference of 11 to 8.98.

The consumers opinions regarding frozen desserts indicated a high regard for ice cream. The principal reasons given for using ice cream were because their families like it, high nutritive value, easy to prepare and serve, and because it makes a good dessert. Of the 200 respondents stating that they serve ice cream in the home, 64.5% served ice cream 3 or more times each week and 73.0% generally serve the ice cream as it comes from the container. In regard to purchasing ice cream, 98.5% said that the ice cream they have been buying has been satisfactory and 50.0% preferred commercial ice cream over home-made ice cream.

The reasons for flavor preference given by the respondents showed that 65.2% listed "better flavor" as a reason for preference, 44.4% "more flavor" and 52.8% "richer taste." Also, 94.4% considered the sample chosen to be "good." Only 16.7% of the respondents gave any criticisms for the samples preferred. For texture preference reasons, 69.1% of the 144 respondents listed "better flavor" and 69.1% listed "better texture."

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